Factors Associated with Emergency Department Visits by Children with Asthma: Implications for Health Education

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ABSTRACT

Objectives. This study investigated the relationship between psychosocial and behavioral factors and the frequency of emergency department visits for childhood asthma.

Methods. Data obtained from a survey of parents of 445 children who were being treated for asthma in the emergency room of a large urban hospital were examined.

Results. Factors associated with high emergency department use included the child's being of younger age, a greater number of days with symptoms of asthma, a higher number of asthma medicines prescribed, a prior hospitalization for asthma, a lower level of parental confidence in the efficacy of medicines, and a failure to use a criterion for deciding to seek emergency care.

Conclusions. Younger children with asthma and children with previous hospitalization for asthma are at high risk for using emergency care. Families who use the emergency department frequently need to be further educated in the inflammatory nature of the disease, in the efficacy of proper use of medicine, in the need for ongoing care, and in criteria to distinguish those symptoms that can be handled at home from those requiring emergency care. (*Am J Public Health.* 1996;86:1410–1415)

Introduction

Surveys of health care use in several major US cities indicate that children with asthma make frequent visits to pediatric emergency departments for asthma.[1,2] This is especially true for low-income families who rely on the emergency department as a primary source of care for this disease.[3,4] These visits represent considerable direct and indirect costs for families and the health care system.[5] There are social and emotional costs as well. Sleep and family living patterns are interrupted, and the child's school attendance and performance can be adversely affected.[6–8] Yet despite the significant toll that these frequent visits exact, few studies have examined the psychosocial and behavioral factors associated with use of the emergency department for asthma. Those studies that have explored this problem have found that both inadequate instruction to parents on the administration of asthma medications and low parental compliance with the therapeutic regimen were associated with high levels of pediatric emergency department use.[9–11]

Several behavioral factors have been related to use of health services. For example, education in the effective home management of asthma has been demonstrated to reduce medical emergencies.[4,12] A person's sense of self-efficacy or confidence to perform recommended health behaviors (such as asthma self-management steps) also has been shown to be a strong predictor of various desired health outcomes.[13,14]

The purpose of the present study was to identify psychosocial and behavioral factors correlated with emergency department use for childhood asthma over the preceding year and to assess the relative importance of these factors. While the study was largely exploratory, from the start we hypothesized that high levels of pediatric emergency department use for asthma would be associated with (1) low levels of parental use of home management practices, both pharmacological and nonpharmacological; and (2) low levels of parental confidence to manage an acute episode of wheezing at home.

Methods

Study Population and Data Collection Procedures

The study was conducted in the pediatric emergency department of the Presbyterian Hospital, a large, urban, nonprofit teaching hospital in New York City. Interviewers approached every parent who brought in a child for breathing problems if all the following criteria were met: (1) the child had a confirmed diagnosis of asthma made by a physician on or before the current visit (hereafter referred to as the baseline visit); (2) the

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child had at least one prior episode of asthma that required medical treatment; and (3) the parent or physician indicated that the reason for the baseline visit was for a problem related to asthma. At the time of the visit, parents were interviewed by project staff in English or Spanish. The interview addressed factors hypothesized to influence emergency service use. The diagnosis of asthma, the emergency department physician's treatment for the baseline visit and for each episode of asthma seen in the department over the previous 12 months, and hospitalizations for asthma were documented in the child's medical record.

Interviewers approached a total of 566 persons who brought children to the emergency department for asthma over a 5-month period. Of these approached, 445 (79%) agreed to be interviewed and 21% declined. Reasons for declining were that the child was too sick (27%), the child was not accompanied by the parent (20%), the parent was tired (17%), the adult accompanying the child was not the usual caretaker (13%), the parent and child left quickly following treatment (10%), and other (13%). It was speculated that children who left more quickly had milder episodes of asthma. No further data on nonresponders are available.

Sampling was done every third day and interviewers were present in the emergency department for 24 hours of each sampling day. This ensured equal representation of all hours of the day and all days of the week (including weekends) and yielded a systematic sample of all children visiting the emergency department during this period. This sample was believed to be free of biasing periodicities with one exception: because the sample was selected during the late fall, winter, and early spring months, it may not represent those who come to the emergency department for pediatric asthma during the warmer months of the year. Generally, health care use for asthma is lower during the summer months. However, although the sample may not be entirely representative, the qualitative relationships observed among the variables are likely to be valid even if their quantitative strengths may be slightly over- or underestimated.

Definition of Variables and Instrumentation

The interview assessed parents' asthma management practices using two measures. One measure was a 12-item index of the pharmacological steps that parents reported taking to manage the baseline episode at home before coming to the emergency department for this visit. Such steps included obtaining medicine, administering it correctly, and using appropriate criteria to decide if the medicine was effective. The second measure was a 5-item index of the nonpharmacological steps that parents reported taking to control the baseline episode of wheezing. These steps included keeping the child adequately hydrated, having the child rest and stay calm, having the child cough to clear mucus, using home remedies, and using techniques such as relaxation exercises to keep the child or parent calm during an episode of asthma. The indexes were derived from a self-management index previously developed by the authors.[15]

Parents' confidence levels regarding their ability to manage the episode of wheezing on the day of the baseline visit were measured with an eight-item scale. The scale assessed their confidence to time the administration of the medicine correctly, to monitor symptoms, to keep self and child calm, and to know when to seek emergency care. Parents rated their confidence for each item using a 5-point Likert response scale ranging from "strongly agree" to "strongly disagree." A modified 10-item self-efficacy scale adapted from Sherer et al.[16] was also used to assess parents' sense of confidence as it related to making plans work, achieving goals, and handling unexpected problems. Parents rated their efficacy for each item again using a 5-point Likert scale ranging from "strongly agree" to "strongly disagree."

The level of stress experienced by the parent in trying to manage the baseline episode was measured by a seven-item scale. The stress scale included feelings of sadness, depression, panic, anger, fear, frustration, and nervousness. Each feeling was rated by parents on a 5-point Likert scale ranging from "strongly agree" to "strongly disagree."

Two additional indexes were developed to measure parents' difficulties administering medicines to the child. One scale consisting of four items assessed specific difficulties on the day of the baseline visit; the other assessed difficulties recurring over the previous 12 months (four items). Parents rated the frequency of problems on a 3-point Likert scale ranging from "always" to "rarely." The internal consistency of each index was assessed by Cronbach's alpha[17]: pharmacological steps to manage baseline episode (.77); nonpharmacological steps to manage baseline episode (.31); confidence to manage baseline episode (.73); general confidence (.65); level of stress when managing baseline episode (.75); difficulty administering medicine to child on day of visit (.67); and difficulty administering medicine to child 12 months prior to the baseline visit (.50).

Open-ended questions were posed to elicit information about alternative sources of health care available to the child and about the families' reasons for using the emergency department. A set of dichotomous questions was also used to assess communication by the families' regular physician with parents about the care of the child's asthma. Two questions inquired whether the physician had provided information to the parents on the prevention of symptoms, the treatment of mild symptoms, and the treatment of severe symptoms. A broader dichotomous question sought to establish whether the physician had worked together with the parents to develop a long-range therapeutic (prospective) plan to manage asthma over the coming months.

A number of sociodemographic and illness-related variables were included to adjust for their expected influence on the number of emergency department visits. These variables included the age and sex of the child, the mother's ethnicity and Medicaid status, the duration of the child's asthma in years, and the severity of the child's asthma. Because severity of asthma may be reflected in both the frequency of attacks and the intensity of an individual attack, it is difficult to quantify severity along a single dimension. Thus, six measures were used, each of which was sensitive to a somewhat different aspect of severity. First, the severity of the baseline episode on the day of the visit was assessed in terms of the final treatment received in the emergency department: mild, if no medications or only oral medications were administered; moderate, if injected or inhaled medications were administered; and severe, if an intravenous medication (theophylline or corticosteroid) was administered or if the child was admitted to the hospital. (The protocol for the use of steroids in the emergency department at the time of data collection was comparable to the present National Heart, Lung, and Blood Institute guidelines; i.e., if the patient did not improve after the initial first hour of beta-agonist treatment [peak expiratory flow rate $<70\%$ predicted or personal best], oral or intravenous steroids were

TABLE 1—Descriptive Characteristics of Study Population (n = 445)

Sociodemographic and illness characteristics	
Respondent is child's mother, %	92
Respondent is Hispanic, %	71
Respondent receives Medicaid, %	75
Male child, %	61
Mean age of child, y	6.5 ± 3.48 SD
Mean duration of child's asthma, y	3.3 ± 3.48 SD
Severity of asthma	
Mean no. days with wheezing in 2 months prior to baseline visit	54.0 ± 87.39 SD
Mean severity of episodes over previous 12 months[a]	2.12 ± 0.39 SD
Episodes were mild, %[a]	8
Episodes were moderate, %[a]	72
Episodes were severe, %[a]	20
Emergency health care use for asthma	
Mean no. ED visits for asthma in 12 months [a]	3.4 ± 3.84 SD
ED visit made during hours when other sources of care unavailable (6 pm to 8 am Monday through Friday and on weekends), %[a]	63
Baseline visits resulting in hospitalization, %[a]	9
Hospitalized for asthma at least once in 12 months prior to baseline visit, %[a]	15
ED visits accounted for by previously hospitalized group, %[a]	39
Mean no. ED visits in group previously hospitalized[a]	6.24 ± 7.49 SD
Mean no. ED visits prior to baseline visit in group not previously hospitalized[a]	1.70 ± 2.18 SD
Total emergency health care costs incurred by previously hospitalized group, %[a]	72
Other sources of health care for asthma	
Other source of health care for asthma, yes, %	64
Physician in private practice, %	50
Outpatient clinic, %	50
Reasons for using the ED for asthma care	
ED medical staff better qualified to treat asthma emergencies, %	16
More effective treatments are available in the ED, %	15
Children with asthma are treated immediately, %	14
ED is open 24 hours a day, %	10
Attack too serious to go elsewhere, %	10
Parental management of asthma	
Physician discussed prospective plan to manage asthma, %	16
Physician discussed ways to prevent symptoms, %	57
Physician discussed ways to treat both mild and severe symptoms, %	56
Had and used a prescription medicine at home to treat the child's asthma, %	87
Reported problems administering the medicine, %	49
Had and used a prescription medicine at home to treat the child's asthma today, %	74
Problems today administering the medicine	
Child refused medicine, %	7
Child spit out medicine, %	9
Child vomited after taking the medicine, %	25
Believe asthma medicines are unsafe to take over long periods of time, %	36
Believe asthma medicines are addictive, %	39
Believe asthma medicines lose their effectiveness over time, %	53

(Continued)

used and nebulized beta-agonist treatments were given every 20 minutes for 2 hours). Second, the same criterion and scoring system was used to calculate the average severity of visits to the emergency department for asthma for each visit in the preceding 12 months as recorded in the child's medical record. Third, the parents assessed the seriousness (mild, moderate, severe) of the child's episode of asthma that provoked the baseline visit. Fourth, the parents assessed the overall seriousness (mild, moderate, severe) of the child's episodes throughout the year. Fifth, severity was measured by parental reports of the number of days during which the child had any symptoms in the 12 months prior to the baseline visit. Sixth, the parents reported the number of days the child was unable to carry out normal activities (play or go to school) because of asthma.

Data Analysis Techniques

Data describing the population are presented either as the mean ± the standard deviation (SD) or as a percentage of responses. For simplicity, SDs were not reported for percentages, but it should be noted that for n = 445, the SD of a 50% rate is 2.4%, that of a 25% or 75% rate is 2.1%, and that of a 10% or 90% rate is 1.4%. The a priori hypotheses were tested using multiple regression techniques. Missing data from interviews and medical records on health care use account for the discrepancy between the original number of cases from which the descriptive data were derived (445) and the number of cases upon which the regression analysis was based (373). The distribution of the number of emergency department visits, like many count distributions, was skewed toward the upper end. A logarithmic transformation of the annual number of emergency department visits was applied, which markedly reduced the skewness of the distribution. Initially, all variables were entered in the model. A backwards elimination procedure was used with the criterion for inclusion set at $P < .05$ (two tailed). Variables not reaching this criterion were eliminated from the model. To make sure that no variables that might be associated with emergency department visits were overlooked, once an index had been eliminated from the model, the constituent variables of that index were entered into the analysis and evaluated using a two-step process: first, variables with $P > .25$ were eliminated from consideration; second, the remaining variables were

entered into the analysis. The final model contained only variables that reached statistical significance at the $P < .05$ level.

Results

Table 1 presents a profile of the study sample, including information on sociodemographic status, duration and severity of asthma, use of health care services, parental management of asthma, and parental stress and confidence levels to manage asthma. The results of the regression analysis are presented in Table 2. Among sociodemographic variables in the study, Medicaid status and age of the child were significantly associated with frequency of emergency department visits. Parents receiving Medicaid made more visits than parents not receiving Medicaid. Younger children with asthma were taken to the emergency department substantially more often than older children.

Our first hypothesis—that parental use of fewer home management practices would be associated with more emergency department visits—was partially supported by the data. Children whose parents did not report using a specific standard (observing improvement after giving medicines) for deciding to continue to treat asthma episodes at home made more visits to the emergency department than children whose parents did report using such a standard. In addition, children whose parents said they did not keep medicines at home because they believed the medicines were unsafe or ineffective or caused side effects also made more emergency department visits than children whose parents did not reject medicines for these reasons.

Use of medicines at home on the day of the contact emergency department visit was positively associated with frequency of emergency department visits in the preceding year. Having medicine at home, the overall number of medicines taken, and the number of adrenergic medicines taken on the day of the baseline visit were all significant positive predictors of emergency department visit frequency.

The second hypothesis—that less parental confidence to manage asthma episodes would be associated with more emergency department visits—was not supported.

Two variables measuring the severity of the child's asthma—frequency of days with asthma symptoms and a previous hospitalization for asthma—were significantly associated with more emergency department visits. In contrast, the greater the average severity of episodes (as rated by the level of treatment received in the emergency department over the past 12 months), the fewer the emergency department visits. Parents who reported that the main reason they visited the emergency department this time was that the attack was too serious to go elsewhere also made fewer visits than parents who reported visiting for other reasons.

A surprising finding was that of the seven factors reflecting stressful feelings, only anger affected emergency department visits. Parents who said they felt angry during the attack made fewer visits for the child's asthma than parents who reported they did not feel angry. We do not have data describing the sources of parents' angry feelings; these could have been related to any aspect of the baseline episode, such as the disruption of sleep, the lack of predictability of episodes, the need to travel at night for emergency department care, and/or the treatment received in the emergency department.

TABLE 1—*Continued*

Mean no. steps taken to manage asthma at home on the day of the contact visit	1.8 ± 1.17 SD
Rubbed child's back to keep child calm and relaxed, %	24
Kept child adequately hydrated, %	18
Used a specific criterion for deciding to continue to treat episodes at home (improvement after giving the medicine), %	69
Parental stress and confidence levels while managing an asthma episode	
Strongly agreed that they experienced stressful feelings such as panic, fright, nervousness, frustration, depression, or sadness, %	41
Strongly agreed that they felt angry during the episode, %	5
Rated themselves at the highest level of confidence in their ability to manage asthma episodes, %	4

Note. ED = emergency department.
[a]Based on data from medical record review, n = 403; all other data are based on parental self-report, n = 445.

TABLE 2—Regression Analysis of the Log of Annual Number of Emergency Department (ED) Visits on the Explanatory Factors[a]

	B	SEB	Beta	*P*	% Change[b]
Medicaid status	.18	.08	.10	.024	20
Child's age	−.02	.008	−.12	.01	−2
No. daily medicines given on day of contact	.31	.05	.28	.0000	36
No. adrenergic medicines given as needed	.27	.07	.18	.0003	31
Parent has a medicine at home today	.29	.10	.14	.003	34
Parents do not have asthma medicine at home because they do not believe medicines work	1.19	.46	.12	.009	229
Parent uses improvement after giving medicine as criterion for home treatment	−.21	.07	−.14	.003	−19
Days with wheezing	.0008	.0004	.10	.04	0.1
Mean severity of ED visits	−.36	.09	−.19	.0000	−30
Ever hospitalized	.26	.07	.17	.0005	30
Attack too serious to go elsewhere	−.11	.04	−.11	.02	−10
Parent felt angry	−.10	.03	−13.003	−11	
Constant	.10	.39		.7994	

[a]N = 373, $R^2 = 0.30$; standard error of regression (SE) = 0.63; F = 13.08; *df* = 12,360; $P = .0000$.
[b]% Change = 100 × [(anti-log B)-1] = % change in frequency of annual ED visits per unit change in explanatory variable.

Another surprising finding was that there were no statistically significant relationships between nonpharmacological management steps or use of nonemergency health care services for asthma and the frequency of emergency department visits.

Discussion

The descriptive data in Table 1 provide some explanation for why families used the emergency department and thus help us interpret the results of the regression analysis. That the great majority of emergency department visits were made at night or during the weekend implies that having no timely alternative source of care was an important reason for families to use the service. However, for a significant minority the belief that superior care was to be found at the emergency department influenced their decisions. Patients, especially those who do not understand the chronic nature of asthma and view it as an episodic disease to be treated intermittently, are likely to see the emergency department as an appropriate source of care. Indeed, for a significant portion of children (20%), by the time they reached the emergency department, their condition was deemed serious by the physician. However, for a small number (8%), emergency treatment was not necessary at all. For them and the 72% whose asthma was of moderate severity, earlier and active at-home management might have turned the episode around so that a trip to the hospital might not have been necessary.

Four other factors suggest that some frequent emergency department user families simply rely on the service for the treatment of symptoms rather than actively managing the symptoms at home. First, the lower the average severity of asthma seen in emergency department visits, the more frequent the visits. Second, parents who did *not* report feeling that the attack was too serious to go elsewhere were more likely to use the emergency department. A third factor supporting the notion that some families get used to seeking emergency department care and do not see it as unusual is that the less angry parents felt during the baseline attack, the more likely they were to make frequent visits. Finally, not having criteria for determining when to treat at home and when to seek medical assistance was a significant predictor of emergency department use. The failure to perform the most basic assessment needed for home management—observing for improvement after giving medicine—was associated with a greater number of emergency department visits.

Most parents had medicines at home and used them on the day of the visit. But more than a third administered medicines with little faith in their efficacy or safety. Many parents reported that the medicine lost effectiveness over time and was addictive if taken continuously. Their resulting lack of confidence in the efficacy and safety of the medicine was a major reason cited by parents to seek help in the emergency department. The fact that families who visited the emergency department more often used more asthma medicines at home on the day of the visit may well be a case of too little too late. Appropriate asthma management usually requires the continuous use of medicines over time. Daily medication use addresses inflammation and can prevent symptoms or turn an episode around before it becomes too serious. Waiting until symptoms flare to administer drugs makes quelling the attack much more difficult and often impossible. Many patients in this study did not see the benefit of early treatment. This is reflected, in part, in their high levels of confidence that they had managed their baseline episodes well even though these episodes resulted in emergency department visits. Education may help parents see that this outcome can be avoided. We believe that the association between use of medicines at home on the day of the visit and more frequent emergency department visits indicates that these asthma attacks were serious. By the time the families went to the emergency department, the children very likely needed care. This fact does not contradict the independent finding that families who did not attempt to manage episodes at home made more visits than those who did attempt such management.

Since a significant number of patients had no source of regular health care or experienced problems at times when only emergency department physicians were available, one might assume that the opportunity for asthma education was limited. In the emergency department, the primary sources of information for patients regarding important asthma concepts are likely to be emergency service clinicians whose opportunity to provide education is constrained. All asthma patients require instruction in the use of metered dose inhalers and spacers. They also need to be clear about the schedule for medicines being recommended. Most need to understand why anti-inflammatory medications are necessary even though patients do not experience immediate relief from them. All patients need to understand that overuse of bronchodilators may have serious consequences.

Data indicate that patients also need both criteria for judging when an episode requires emergency care or can be managed at home, and guidelines for managing attacks at home. This information would include how to use medicines when symptoms begin to worsen and how long to wait to see if things are turning around. All patients would need to know the signs for seeking help immediately (chest retractions, cyanotic lips and nail beds).

The data also reveal that parents hold a number of health beliefs that interfere with the proper management of asthma. Implicit in these data are beliefs that (1) periodic crises are to be expected and require emergency department service, (2) medicines are not efficacious, (3) asthma is an acute (vs chronic) illness, and (4) asthma is not serious. These beliefs work against the clinical reality that airway inflammation and hyperresponsiveness are often present even when symptoms of asthma are not and that these reactions require daily self-management with ongoing guidance from a physician.

This study provides educators, planners, and other health professionals with useful information related to reducing emergency department visits for asthma. Data show that younger children with asthma and children who have been previously hospitalized for asthma are two groups who are at high risk for using emergency care and are thus particularly deserving of ameliorative interventions. An ongoing source of clinical care that provides effective asthma education would likely reduce these children's use of the emergency department for asthma. Certain elements of education are likely to be most important for families who frequently use the emergency department. In addition to acquiring specific skills (such as how to use metered dose inhalers and spacers), patients need to recognize that (1) asthma is a chronic disease in which underlying inflammation may be present, even when there are no symptoms; (2) optimum management of asthma requires ongoing communication with a clinician who tailors medicines to the patient's needs and provides instruction on its optimum use, including a long-term plan on how to respond to changing clinical conditions; (3) asthma is a serious disease that often requires daily treat-

ment; (4) reliance on episodic management alone puts a child at risk for more severe episodes of asthma; (5) medicines taken appropriately can be efficacious; and (6) criteria can be used by families to distinguish those increases in symptoms that demand emergency service from those that can be effectively handled at home. Efforts to provide some or all of these educational elements should also be systematically explored in the emergency department setting as such a large percentage of parents use this facility as their regular source of asthma care. □

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References

1. Gergen PJ, Weiss KB. Changing patterns of asthma hospitalization among children: 1979 to 1987. *JAMA.* 1990;264:1688–1692.
2. Weiss KB, Gergen PJ, Crain EF. Inner-city asthma. The epidemiology of an emerging US public health concern. *Chest.* 1992;101: 362S–367S.
3. Proceedings of the asthma mortality task force, November 13–16, 1986. *J Allergy Clin Immunol.* 1987;80:361–514.
4. Clark NM, Feldman CH, Evans D, Levison ML, Wasilewski Y, Mellins RB. The impact of health education on frequency and cost of health care utilization by low-income children with asthma. *J Allergy Clin Immunol.* 1986;78:108–115.
5. Sullivan SD, Weiss KB. Assessing cost-effectiveness in asthma care: building an economic model to study the impact of alternative intervention strategies. *Allergy.* 1993;48:146–152.
6. Wasilewski Y, Clark NM, Evans D, et al. The effect of paternal social support on maternal disruption caused by childhood asthma. *J Community Health.* 1988;13: 33–42.
7. Parcel GS, Gilman SC, Nader PR, Bunce H. A comparison of absentee rates of elementary school children with asthma and nonasthma schoolmates. *Pediatrics.* 1979;64:878–881.
8. Freudenberg N, Feldman CH, Clark NM, Millman EJ, Valle I, Wasilewski Y. The impact of bronchial asthma on school attendance and performance. *J Sch Health.* 1980;50:522–526.
9. Eney RD, Goldstein EO. Compliance of chronic asthmatics with oral administration of theophylline as measured by serum and salivary levels. *Pediatrics.* 1976;57:513.
10. Sublett JL. Non-compliance in asthmatic children: a study of theophylline levels in a pediatric emergency room population. *Ann Allergy.* 1979;43:95–97.
11. O'Brian SR, Hein EW, Sly RM. Treatment of acute asthmatic attacks in a holding unit of a pediatric emergency room. *Ann Allergy.* 1980;45:159–162.
12. Hindi-Alexander MC, Cropp GJA. Evaluation of a family asthma program. *J Allergy Clin Immunol.* 1984;74:505–510.
13. Clark NM, Rosenstock I, Hassan H, et al. The effect of health beliefs and feelings of self-efficacy on self-management behavior of children with a chronic disease. *Patient Educ Counsel.* 1988;11:131–139.
14. Strecher V, DeVellis BM, Becker M, Rosenstock I. The role of self-efficacy in achieving behavior change. *Health Educ Q.* 1986;13:73–91.
15. Clark NM, Feldman CH, Evans D, et al. Managing better: children, parents, and asthma. *Patient Educ Counsel.* 1986;8: 27–38.
16. Sherer M, Maddux JE, Mercante B, Prentice-Bunn S, Jacobs B, Rogers RW. Construction and validation of a self-efficacy index. *Psychol Rep.* 1982;51:663–671.
17. Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika.* 1951;16:297.